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Interference effects of the superconducting pairing wavefunction due to the Fulde-Ferrell-Lark-n-Ovchinnikov like state in ferromagnet/superconductor bilayers

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Abstract

The theoretical description of the Fulde-Ferrell-Larkin-Ovchinnikov like state establishing in nanostructured bilayers of ferromagnetic (F) and superconducting (S) material leads to critical temperature oscillations and reentrant superconductivity as the F layer thickness gradually increases. The experimental realization of these phenomena is an important prerequisite for the fabrication of the ferromagnet/superconductor/ferromagnet core structure of the superconducting spin-valve. A switching of the spin-valve is only expected if such non-monotonic critical temperature behavior is observed in F/S bilayers as well as in the S/F bilayers, a combination of which the spin-valve core structure can be regarded to consist of. In our former investigations we could demonstrate the required non-monotonic behavior of the critical temperature in S/F bilayers. In this study we succeeded in the preparation of F/S bilayers, where the superconducting material is now grown on top of the ferromagnetic metal, which shows deep critical temperature oscillations as a function of the ferromagnetic layer thickness as well as an extinction and recovery, i.e.a reentrant behavior, of superconductivity. In particular, the latter is necessary to obtain a spin-valve with a large critical temperature shift between the parallel and antiparallel configurations of magnetizations in the F layers.

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